SEQUENCE LISTING

<110> Lu, Shan
      Pal, Ranajit
      Kalyanaraman, V.S.
      Whitney, Stephen Charles
      Keen, Tim

<120> POLYVALENT, PRIMARY HIV-1 GLYCOPROTEIN
      DNA VACCINES AND VACCINATION METHODS

<130> 07917-269001

<140> US 10/728,195
<141> 2003-12-03

<150> US 60/430,732
<151> 2002-12-03

<160> 21

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<220>
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caagcggctg acggaaaggt cagtcaaaat tatcctatag tgcagaatct ccaagggcaa       420
atggtacacc agaaactatc acctagaact ttgaatgcat gggtaaaagt aatagaagaa       480
aaagctttta gcccagaggt aatacccatg tttacagcat atcagaagg agccaccca       540
caagatttaa acaccatgtt aaatacagtg gggggacatc aagcagccat gcaaatgtta       600
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accctccaag aacagatagc atggatgaca agtaatcccc ctattccagt gggagacatc       780
tataaaagat ggataattct ggggttaaat aaaatagtaa gaatgtatag ccctgtcagc       840
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agaaattgca gggcccctag gaaaaagggc tgttggaaat gtggaaagga gggacaccaa      1260
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ggaaggccag ggaatttcct tcagaacagg ccagagccaa cagccccacc agcagagagc      1380
ttcaggttcg aggagacaac ccccgctccg aagcaggagt cgaaagacag gaagccctta      1440
acttccctca aatcactctt tggcagcgac cccttgtctc aataa                      1485

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<211> 1485
<212> DNA
<213> Artificial Sequence

<220>
<223> Codon optimized Gag.Czm DNA sequence

<400> 6
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ctgcggcctg gaggcaagaa acggtacatg atcaagcacc tggtgtgggc cagcagagag       120
ctggagcggt cgcactgaa tcctggcctc ctggagacca gcgaaggatg caaacagatc       180
atgaagcagc tccaaccagc tctgcagacc ggcactgagg aactgagaag cctgtacaac       240
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accgtggcca ccctgtactg cgtgcacgag ggcgtggaag tgcgggacac caaggaggcc      300
ctggaccgga tcgaggaaga gcagaacaag atccagcaaa agatccagca gaagacccaa      360
caggccgctg atggaaaggt gagccagaac taccccatcg tccagaacct ccagggccag      420
atggtgcacc agaagctgag ccctcggaca ctgaacgcct gggtcaaggt gatcgaagag      480
aaggccttca gccctgaagt gatccccatg ttcacagctc tgagcgaagg cgccactcct      540
caggacctga acaccatgct gaacaccgtg ggaggccacc aagctgcaat gcagatgctg      600
aaggacacca tcaacgagga agctgccgag tgggacagac tgcatccagt ccacgccgga      660
cccatcgctc ctggccagat gcgggaacct agaggaagcg atatcgctgg cactacctcc      720
accctgcaag agcagatcgc ttggatgacc agcaaccccc ctatccccgt cggcgacatc      780
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aagactctga gagccgagca ggcaacccag gaggtgaaga actggatgac cgacacactg      960
ctggtccaga acgccaaccc cgactgcaag accatcctga aggctctggg acccggcgcc     1020
acactggaag agatgatgac agcatgccag ggcgtcggag accaagcca caaagcaaga     1080
gtgctcgccg aggccatgag ccagaccaac agcgtgaata tcctgatgca gaagagcaac     1140
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cggaactgca gagctccacg gaagaaaggc tgctggaagt gcggcaagga aggacaccag     1260
atgaaggact gcacagagcg gcaagcaaac ttcctcggaa agatctggcc aagccacaag     1320
ggaagacccg gcaatttcct gcagaacaga cctgagccca ccgcccccacc tgctgagagc     1380
ttccggttcg aagagaccac acccgccccc aagcaggaga gcaaggacag agaagcactg     1440
accagcctga gagcctgtt cggcagcgat cccctgagcc agtga                      1485
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<210> 7
<211> 1422
<212> DNA
<213> Human immunodeficiency virus

<400> 7

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tgtgcatcag atgctaaagc atatgataca gaggtacata atgtttgggc cacacatgcc      120
tgtgtaccca cagaccccaa cccacaagaa gtagaattgg aaaatgtgac agaaaatttt      180
aacatgtgga aaataacat ggtagaacag atgcatgagg atataatcag tttatgggat      240
caaagcctaa agccatgtgt aaaattaact ccactctgtg ttactttaaa ttgcactgat      300
ttgaggaatg ctactaatgg gaatgacact aataccacta gtagtagcag ggaaatgatg      360
gggggaggag aaatgaaaaa ttgctctttc aaaatcacca aaacataag aggtaaggtg      420
cagaaagaat atgcactttt ttatgaactt gatatagtac caatagataa taatagtaat      480
aatagatata ggttgataag ttgtaacacc tcagtcatta cacaggcctg tccaaagata      540
tcctttgagc caattcccat acattattgt gccccggctg gttttgcgat tctaaagtgt      600
aaagataaga agttcaatgg aaaaggacca tgttcaaatg tcagcacagt acaatgtaca      660
catgggatta ggccagtagt atcaactcaa ctgctgttaa atggcagtct agcagaagaa      720
gaggtagtaa ttagatccga aaatttcgcg gacaatgcta aaaccataat agtacagctg      780
aatgaatctg tagaaattaa ttgtacaaga cccaacaaca atacaagaaa aagtatacat      840
ataggaccag gcagagcatt atatacaaca ggagaaataa taggagatat aagacaagca      900
cattgtaacc ttagtagagc aaaatggaat gacactttaa ataagatagt tataaaatta      960
agagaacaat ttgggaataa aacaatagtc tttaagcatt cctcaggagg ggacccagaa     1020
attgtgacgc acagttttaa ttgtggaggg gaattttttct actgtaattc aacacaactg     1080
tttaatagta cttggaatgt tactgaagag tcaaataaca ctgtagaaaa taacacaatc     1140
acactcccat gcagaataaa acaaattata aacatgtggc agaaagtagg aagagcaatg     1200
tatgcccctc ccatcagagg acaaattaga tgttcatcaa atattacagg ctgctatta     1260
acaagagatg gtggtccaga ggcaaacaag accgaggtct tcagacctgg aggaggagat     1320
atgagggaca attggagaag tgaattatat aaatataaag tagtaaaaat tgaaccatta     1380
ggagtagcac ccaccaaggc aaagagaaga gtggtggagt aa                        1422
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<210> 8
<211> 1422
<212> DNA
<213> Artificial Sequence

```
<220>
<223> Codon optimized gp120.Bal DNA sequence

<400> 8
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tgcgccagcg accgcaaggc ctacgacacc gaggtgcaca acgtgtgggc cacccacgcc     120
tgcgtgccca ccgaccccaa cccccaggag gtggagctga agaacgtgac cgagaacttc     180
aacatgtgga agaacaacat ggtggagcag atgcacgagg acatcatcag cctgtgggac     240
cagagcctga gccctgcgt gaagctgacc cccctgtgcg tgaccctgaa ctgcaccgac     300
ctgcgcaacg ccaccaacgg caacgacacc aacaccacta gtagcagccg cggcatggtg     360
ggcggcggcg agatgaagaa ctgcagcttc aacatcacca ccaacatccg cggcaaggtg     420
cagaaggagt acgccctgtt ctacaagctg gacatcgccc ccatcgacaa caacagcaac     480
aaccgctacc gcctgatcag ctgcaacacc agcgtgatca cccaggcctg ccccaaggtg     540
agcttcgagc ccatccccat ccactactgc gcccccgccg gcttcgccat cctgaagtgc     600
aaggacaaga agttcaacgg caagggcccc tgcaccaacg tgagcaccgt gcagtgcacc     660
cacggcatcc gccccgtggt gagcacccag ctgctgctga acggcagcct ggccgaggag     720
gaggtggtga tccgcagcgc caacttcgcc gacaacgcca aggtgatcat cgtgcagctg     780
aacgagagcg tggagatcaa ctgcacccgc cccaacaaca caccccgcaa gtccatccac     840
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cactgcaacc tgagccgcgc caagtggaac gacacccctga caagatcgt gatcaagctg     960
cgcgagcagt cggcaacaa gaccatcgtg ttcaagcaca gcagcggcgg cgaccccgag    1020
atcgtgaccc acagcttcaa ttgcggcggc gagttcttct actgcaacag cacccagctg    1080
ttcaacagca cctggaacgt gaccgaggag agcaacaaca ccgtggagaa caacaccatc    1140
accctgccct gccgcatcaa gcagatcatc aacatgtggc aggaggtggg ccgcgccatg    1200
tacgccccc catccgcgg ccagatccgc tgcagttcga acatcaccgg cctgctgctg    1260
acccgcgacg gcggccccga ggacaacaag accgaggtgt ccgcccccgg cggcggcgac    1320
atgcgcgaca actggcgcag cgagctgtac aagtacaagg tggtgaagat cgagcccctg    1380
ggcgtggccc ccaccaaggc caagcgccgc gtggtggagt aa                     1422

<210> 9
<211> 1422
<212> DNA
<213> Human immunodeficiency virus

<400> 9
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tgtgcatcag atgctaaagc atatgataca gaggtacata atgtttgggc cacacatgcc     120
tgtgtaccca cagaccccga tccacaagaa gtagaattgg aaaatgtgac agaaaatttt     180
aacatgtgga aaaataacat ggtagaacag atgcatgagg atataattag tttatgggat     240
caaagcctaa agccatgtgt aaaattaacc ccactctgtg ttactctaaa ttgcaccaat     300
ctgaggaatg atactaatac cacgaggaat gctactaata ccacgagtag tgagacaatg     360
atggaggagg gagaaataaa aaattgctct ttcaatatca ccacaagcat aagagataag     420
gtgcaaaaag aatttgcact tttttataaa cttgatgtag taccaataga aaatgatact     480
actagctata ggttgataag ttgtaatacc tcagtcctta cacaggcctg cccaaaggta     540
tcctttgagc caattcccat acattttgt gccccggctg gttttgcaat tctaaagtgt     600
aaagataaga agttcaatgg aacaggacca tgtacaaatg tcagcacagt acaatgcaca     660
catggaatta agccagtagt atcaactcaa ctgctgttaa atggcagtct agcagaagaa     720
gaggtagtaa ttaggtccgc caatctctcg gacaatgcta aaaccataat agtacagctg     780
aatgaatctg tacaaatgaa ttgtacgaga cccaacaaca atacaagaaa aagtatacat     840
ataggaccag gcagagcatt ttatacaaca ggagaaataa taggagatat aagacaagca     900
cattgtaacc ttagtagaac aaaatggaat gaactttaa aaggatagt tataaaatta     960
agagagcaat atgagaataa aacaatagtc tttaatcaat cctcaggagg ggacccagaa    1020
attgtaatgc tcagctttaa ttgtggaggg gaatttttct actgtaattc aacaaaactg    1080
tttaatagta cttggaatgg tactgagtca ataacacag gagatgaccc aatcgtactc    1140
ccatgcagaa taaaacaagt tataaacatg tggcaagaag taggaaaagc aatgtatgcc    1200
cctcccatca gaggacaaat tagatgctca tcaaatatta caggactgct attaacaaga    1260
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gatggtggta acagtaacga gaccaatacc accgagatct tcagacctgg gggaggaaat      1320
atgaaggaca attggagaag tgaattatat aaatataaag tagtaagaat tgaaccatta      1380
ggaatagcac ccaccagggc aaagagaaga gtggtggagt aa                        1422
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<210> 10
<211> 1422
<212> DNA
<213> Artificial Sequence

<220>
<223> Codon optimized gp120.B DNA sequence

<400> 10
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tgtgtgccca ccgaccccga ccctcaggag gtggagctgg agaacgtgac cgaaaacttc       180
aacatgtgga agaataacat ggtggagcag atgcatgagg atatcattag cctgtgggac       240
cagagcctaa agccctgcgt gaagctgacc cccctgtgtg tgactctgaa ctgcaccaac       300
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gtgcagaagg agtttgccct tttctataaa cttgatgtgg tgcctatcga gaatgacact       480
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aaggataaga agttcaacgg caccggtcct tgtaccaatg tcagcaccgt acaatgcacc       660
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gaggtggtga ttcgctccgc caacctctct gacaatgcta agaccataat cgtgcagctg       780
aacgagtctg tgcagatgaa ctgcacgagg cccaacaaca ataccaggaa gagtatccat       840
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cactgtaacc ttagcaggac aaagtggaac gagactctga agaggatcgt gatcaagctg       960
agggagcagt acgagaacaa gaccatcgtc tttaatcaat ccagcggcgg ggaccctgag      1020
attgtgatgc tgagcttcaa ctgcggtggg gagttcttct actgtaactc aaccaagctg      1080
tttaatagca cttggaacgg cactgagtct aacaacaccg tgatgacccc catcgtgctg      1140
ccatgcagga tcaagcaggt gatcaacatg tggcaggaag tgggcaaggc catgtatgcc      1200
cctcccatca ggggtcagat taggtgcagc agcaatatta ccggcctgct actgacccgc      1260
gacggcggta acagcaacga gaccaacacc accgagatct tcaggcctgg gggcggcaac      1320
atgaaggaca attggaggag cgagttatac aaatataagg tggtgaggat tgagcctctg      1380
ggtatcgccc ccaccagggc caagaggagg gtggtgcagt aa                        1422
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<210> 11
<211> 1443
<212> DNA
<213> Human immunodeficiency virus

<400> 11
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tgtgtaccca cagaccccaa cccacaagaa atagttttgg aaatgtaac agaaaatttt       180
aacatgtgga aaaatgacat ggtggatcag atgcatgagg atataatcag tttatgggat       240
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aaaaagaatg tgtatgcact tttttataaa cttgatatag tatcacttaa tgagactgac       480
gactctgaga ctggcaactc tagtaaatat tatagattaa taaattgtaa tacctcagcc       540
ctaacacaag cctgtccaaa ggtctctttt gacccaattc ctatacatta ttgtgctcca       600
gctggttatg cgattctaaa gtgtaataat aagacattca atgggacagg accatgccat       660
aatgtcagca cagtacaatg tacacatgga attaagccag tggtatcaac tcaactactg       720
ttaaatggta gcctagcaga agaagggata ataattagat ctgaaaatct gacaaacaat       780
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gtcaaaacaa taatagtaca tcttaataga tctatagaaa ttgtgtgtgt aagacccaac        840
aataatacaa gacaaagtat aagaatagga ccaggacaaa cattctatgc aacaggagac        900
ataataggag acataagaca agcacattgt aacattagta ggactaactg gactaagact        960
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ccatcctcag gaggggacct agaaattaca acacatagct ttaattgtag aggagaattt       1080
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acacccatca cactcccatg cagaataaga caaattataa atatgtggca ggaagtagga       1200
cgagcaatgt acgcccctcc cattgaagga aacatagcat gtaaatcaga tatcacaggg       1260
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ttcagacctg caggaggaga tatgagggac aattggagga gtgaattgta taagtataaa       1380
gtggtagaaa ttaagccatt gggaatagca cccactgagg caaaaaggag agtggtggag       1440
taa                                                                    1443
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<210> 12
<211> 1464
<212> DNA
<213> Artificial Sequence

<220>
<223> Codon optimized gp120.Czm DNA sequence

<400> 12
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acccacgcct gcgtgcccac cgaccccaac ccccaggaga tcgtgctggg caacgtgacc        180
gagaacttca acatgtggaa gaacgacatg gtggaccaga tgcacgagga tcatcagc        240
ctgtgggacc agagcctgaa gccctgcgtg aagctgaccc cctgtgcgt gaccctgaac        300
tgcaccgagg tgaacgtgac ccgcaacgtg aacaacagcg tggtgaacaa caccaccaac        360
gtgaacaaca gcatgaacgg cgacatgaag aactgcagct tcaacatcac caccgagctg        420
aaggacaaga gaagaacgt gtacgccctg ttctacaagc tggacatcgt gagcctgaac        480
gagaccgacg acagcgagac cggcaacagc agcaagtact accgcctgat caactgcaac        540
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tgcgccccg ccggctacgc catcctgaag tgcaacaaca gaccttcaa cggcaccggc        660
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cagctgctgc tgaacggcag cctggccgag gagggcatca tcatccgcag cgagaacctg        780
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accggcgaca tcatcggcga catccgccag gcccactgca acatcagccg caccaactgg        960
accaagaccc tgcgcgaggt cgcaacaag ctgcgcgagc acttccccaa caagaacatc       1020
accttcaagc ccagcagcgg cggcgacctg gagatcacca cccacagctt caactgccgc       1080
ggcgagttct tctactgcaa caccagcggc ctgttcagca tcaactacac cgagaacaac       1140
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gaggtgggcc gcgccatgta cgcccccccc atcgagggca catcgcctg caagagcgac       1260
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accgagatct ccgcccccgc cggcggcgac atgcgcgaca actggcgcag cgagctgtac       1380
aagtacaagg tggtggagat caagcccctg ggcatcgccc ccaccgaggc caagcgccgc       1440
gtggtggagc gcgagaagcg ctga                                             1464
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<210> 13
<211> 1407
<212> DNA
<213> Human immunodeficiency virus

<400> 13
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tgtgcatcag atgccaaagc acatgagaca gaagtgcaca atgtctgggc cacacatgcc        120
tgtgtaccca cagaccccaa cccacaagaa atacacctgg aaaatgtaac agaaaatttt        180
```

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aacatgtgga aaaataaaat ggtagagcag atgcaggagg atgtaatcag tttatgggat      240
caaagtctaa agccatgtgt aaagttaact cctctctgcg ttactttgac ttgtaccaat      300
gctactctga attgtaccaa tttgaccaat ggcaataaga caactaatgt ctctaacata      360
ataggaaatc taacagatga agtaagaaac tgttcttttc atatgaccac agaactaaga      420
gataagaagc agaaggtcta tgcacttttt tataagcttg atatagtaca aattaatagt      480
agtgagtata ggttaataaa ttgtaatact tcagtcatta agcaggcttg tccaaagata      540
tcctttgatc caattcctat acattattgt actccagctg gttatgcgat tttaaagtgt      600
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catggaatta agccagtggt atcaactcaa ttgctgttaa atggcagtct agcagaagaa      720
gagataataa tcagctctga aaatctcaca aacaatgcca aaaccataat agtgcacctt      780
aataaatctg tagaaatcag ttgtaccaga ccctccacca atacaagaac aagtatacgt      840
ataggaccag gacaagtatt ctatagaaca ggagacataa caggagatat aagaaaagca      900
tattgtgaga ttaatgaaac aaaatggaat gaagctttaa aacaggtagc tgggaaatta      960
aaagaacact taataagac aataatcttt caaccaccct caggaggaga tctagaaatt      1020
acaatgcatc attttaattg tagaggggaa ttttttctatt gcgatacaac acaactgttt      1080
aatagaactt ggggagaaaa tgaaaccaga gaggggcgta atatcacact tccatgcaag      1140
ataaagcaaa ttgtaaacat gtggcaggga gcagggcaag caatgtatgc tcctcccatc      1200
agtggaataa ttaagtgtgt atcaaatatt acaggaatac tattgacaag agatggtggt      1260
gctaataatt cggctagtga gaccttcaga cctggaggag gaaatataaa ggacaattgg      1320
agaagtgaat tatataaata taaagtagta caaattgaac cactaggaat agcacccacc      1380
agggcaaaga gaagagtggt ggagtaa                                          1407
```

<210> 14
<211> 1407
<212> DNA
<213> Artificial Sequence

<220>
<223> Codon optimized gp120.E DNA sequence

<400> 14
```
ctgtgggtga ccgtgtacta cggcgtgccc gtgtggaagg acgccgacac caccctgttc      60
tgcgccagcg acgccaaggc ccacgagacc gaggtgcaca cgtgtgggc caccccacgcc      120
tgcgtgccca ccgaccccaa cccccaggag atccacctgg agaacgtgac cgagaacttc      180
aacatgtgga agaacaagat ggtggagcag atgcaggagg acgtgatcag cctgtgggac      240
cagagcctga gccctgcgt gaagctgacc cccctgtgcg tgaccctgac ctgcaccaac      300
gccaccctga actgcaccaa cctgaccaac ggcaacaaga ccaccaacgt gagcaacatc      360
atcggcaacc tgaccgacga ggtgcgcaac tgcagcttcc acatgaccac cgagctgcgc      420
gacaagaagc agaaggtgta cgccctgttc tacaagctgg acatcgtgca gatcaacagc      480
agcgagtacc gcctgatcaa ctgcaacacc agcgtgatca gcaggcctg ccccaagatc      540
agcttcgacc ccatccccat ccactactgc accctgctg gctacgccat cctgaagtgc      600
aacgacaaga acttcaacgg caccggaccc tgcaagaacg tgagcagcgt gcagtgcacc      660
cacggcatca gcccgtggt gagcacccag ctgctgctga cggcagcct ggccgaggag      720
gagatcatca tcagcagcga gaacctgacc aacaacgcca gaccatcat cgtgcacctg      780
aacaagagcg tggagatcag ctgcactcgc cccagcacca cacccgcac cagcatccgc      840
atcggacctg gccaggtgtt ctaccgcacc ggcgacatca ccggcgacat ccgcaaggcc      900
tactgcgaga tcaacgagac caagtggaac gaggccctga gcaggtggc cggcaagctg      960
aaggagcact tcaacaagac catcatcttc cagcctccca gcggaggcga cctggagatc      1020
accatgcacc acttcaactg cagaggcgag ttcttctact cgacaccac ccagctgttc      1080
aaccgcacct ggggcgagaa cgagacccgc gagggcagga acatcaccct gccctgcaag      1140
atcaagcaga tcgtgaacat gtggcaggga ctggccaggt ccatgtacgc ccacccatc      1200
agcggcatca tcaagtgcgt gagcaacatc accggcatcc tgctgacccg cgacggcggt      1260
gccaacaaca gcgccagcga gaccttcagg ccaggcggtg gcaacatcaa ggacaactgg      1320
cgcagcgagc tgtacaagta caaggtggtg cagatcgagc ccctgggcat cgcccccact      1380
cgcgccaagc gccgcgtggt ggagtaa                                          1407
```

<210> 15

<211> 1410
<212> DNA
<213> Human immunodeficiency virus

<400> 15
```
ttgtgggtca cagtctatta tggggtacct gtgtggaaag atgcagagac taccttattt       60
tgtgcatcag atgcgaaagc atatgataca gaagtgcata atgtctgggc tacgcatgcc      120
tgtgtaccta cagaccccaa cccacaagaa atatatatgg aaaatgtgac agaagagttt      180
aacatgtgga aaaataacat ggtagagcag atgcatacag atataatcag tctatgggac      240
caaagcctaa aaccatgtgt acagttaacc cctctctgcg ttactttaga ttgtagctat      300
aacatcacca ataatatcac caatagcatc accaatagct cagttaacat gagagaagaa      360
ataaaaaact gctctttcaa tatgaccaca gaattaaggg ataagaatcg gaaggtatat      420
tcactttttt ataaacttga tgtagtacaa attaataatg gtaataacag tagtaatctg      480
tatagattaa taaattgtaa tacctcagcc cttacacagg cttgtccaaa ggtaaccttt      540
gagccaattc ccatacgtta ttgtgcccca gctggttatg cgattctaaa atgtaatgat      600
aaggagttca tggaacagg gctatgcaaa aatgtcagca cagtgcaatg cacacatgga      660
atcaggccag tagtatcaac tcaactgctg ttaaatggca gtttagcaga aggaaaggta      720
atgattagat ctgaaaatat cacaaacaat gtcaaaaaca taatagtaca acttaacgag      780
actgtaacaa ttaattgtac cagacctaac aacaatacaa gaaaaagtgt acgtatagga      840
ccaggacaaa cattctatgc aacaggtgat ataatagggg atataagaca agcacattgt      900
aatgtcagtg ggtcacaatg aatagagct ttacaccagg tagttggaca attaagagaa      960
tactggaaca caacaataat ctttaaaaac tcctcaggag gggatttaga aattacaaca     1020
catagtttta attgtggagg agaatttttc tattgtaata catcaggcct gtttaatagt     1080
aattggacac ataatgacac tgccagcatg aaaccaaatg acactataac actcccatgc     1140
agaataaagc aaattataaa tatgtggcag agagtaggac aagcaatata tgcccctccc     1200
attcaaggag taataaggtg tgaatcaaac attacaggac taatattaac aagagatggt     1260
ggggggtaaca tcaatgaaag tcaaatcttc agacctggag gaggagatat gagggacaat     1320
tggagaagtg aattatataa gtataaggta gtaagaattg aaccactagg agtagcaccc     1380
accaaggcaa agagaagagt ggtggagtaa                                       1410
```

<210> 16
<211> 1410
<212> DNA
<213> Artificial Sequence

<220>
<223> Codon optimized gp120.A DNA sequence

<400> 16
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ctgtgggtga ccgtgtacta cggcgtgccc gtgtggaagg acgccgagac caccctgttc       60
tgcgccagcg acgccaaggc ctacgacacc gaggtgcaca cgtgtgggc cacccacgcc      120
tgcgtgccca ccgaccccaa cccccaggag atctacatgg agaacgtgac cgaggagttc      180
aacatgtgga agaacaacat ggtggagcag atgcacaccg acatcatcag cctgtgggac      240
cagagcctga gccctgcgt gcagctgacc cccctgtgcg tgaccctgga ctgcagctac      300
aacatcacca caacatcac caacagcatc accaacagca gcgtgaacat cgcgaggag      360
atcaagaact gcagcttcaa catgaccacc gagctgcgcg acaagaaccg caaggtgtac      420
agcctgttct acaagctgga cgtggtgcag atcaacaacg gcaacaacag cagcaacctg      480
taccgcctga tcaactgcaa caccagcgcc ctgacccagg cctgccccaa ggtgaccttc      540
gagcccatcc ccatccgcta ctgcgccccc gccggctacg ccatcctgaa gtgcaacgac      600
aaggagttca cggcaccgg cctgtgcaag aacgtgagca ccgtgcagtg cacccacggc      660
atccgccccg tggtgagcac ccagctgctg ctgaacggca gcctggccga gggcaaggtg      720
atgatccgca gcgagaacat caccaacaac gtgaagaaca tcatcgtgca gctgaacgag      780
accgtgacca tcaactgcac ccgccccaac aacaacaccc gcaagagcgt cgcatcggc      840
cccggccaga ccttctacgc caccggcgac atcatcggcg acatccgcca ggcccactgc      900
aacgtgagcg gcagccagtg aaccgcgcc ctgcaccagg tggtgggcca gctgcgcgag      960
tactggaaca ccaccatcat cttcaagaac agcagcggcg gcgacctgga gatcaccacc     1020
cacagcttca actgcggcgg cgagttcttc tactgcaaca ccagcggcct gttcaacagc     1080
```

```
aactggaccc acaacgacac cgccagcatg aagcccaacg acaccatcac cctgccctgc      1140
cgcatcaagc agatcatcaa catgtggcag cgcgtgggcc aggccatcta cgcccctccc      1200
atccagggcg tgatccgctg cgagagcaac atcaccggcc tgatcctgac ccgcgacggc      1260
ggcggcaaca tcaacgagag ccagatcttc cgccccggcg cggcgacat gcgcgacaac      1320
tggcgcagcg agctgtacaa gtacaaggtg gtgcgcatcg agcccctggg cgtggccccc      1380
accaaggcca agcgccgcgt ggtggagtaa                                       1410
```

<210> 17
<211> 470
<212> PRT
<213> Human immunodeficiency virus

<400> 17

```
Ser Leu Trp Val Thr Val Tyr Tyr Gly Val Pro Val Trp Lys Asp Ala
 1               5                  10                  15
Glu Thr Thr Leu Phe Cys Ala Ser Asp Ala Lys Ala Tyr Asp Thr Glu
             20                  25                  30
Val His Asn Val Trp Ala Thr His Ala Cys Val Pro Thr Asp Pro Asn
         35                  40                  45
Pro Gln Glu Ile Tyr Met Glu Asn Val Thr Glu Glu Phe Asn Met Trp
     50                  55                  60
Lys Asn Asn Met Val Glu Gln Met His Thr Asp Ile Ile Ser Leu Trp
 65                  70                  75                  80
Asp Gln Ser Leu Lys Pro Cys Val Gln Leu Thr Pro Leu Cys Val Thr
                 85                  90                  95
Leu Asp Cys Ser Tyr Asn Ile Thr Asn Asn Ile Thr Asn Ser Ile Thr
             100                 105                 110
Asn Ser Ser Val Asn Met Arg Glu Glu Ile Lys Asn Cys Ser Phe Asn
         115                 120                 125
Met Thr Thr Glu Leu Arg Asp Lys Asn Arg Lys Val Tyr Ser Leu Phe
     130                 135                 140
Tyr Lys Leu Asp Val Val Gln Ile Asn Asn Gly Asn Asn Ser Ser Asn
145                 150                 155                 160
Leu Tyr Arg Leu Ile Asn Cys Asn Thr Ser Ala Leu Thr Gln Ala Cys
                 165                 170                 175
Pro Lys Val Thr Phe Glu Pro Ile Pro Ile Arg Tyr Cys Ala Pro Ala
             180                 185                 190
Gly Tyr Ala Ile Leu Lys Cys Asn Asp Lys Glu Phe Asn Gly Thr Gly
         195                 200                 205
Leu Cys Lys Asn Val Ser Thr Val Gln Cys Thr His Gly Ile Arg Pro
     210                 215                 220
Val Val Ser Thr Gln Leu Leu Leu Asn Gly Ser Leu Ala Glu Gly Lys
225                 230                 235                 240
Val Met Ile Arg Ser Glu Asn Ile Thr Asn Asn Val Lys Asn Ile Ile
                 245                 250                 255
Val Gln Leu Asn Glu Thr Val Thr Ile Asn Cys Thr Arg Pro Asn Asn
             260                 265                 270
Asn Thr Arg Lys Ser Val Arg Ile Gly Pro Gly Gln Thr Phe Tyr Ala
         275                 280                 285
Thr Gly Asp Ile Ile Gly Asp Ile Arg Gln Ala His Cys Asn Val Ser
     290                 295                 300
Gly Ser Gln Trp Asn Arg Ala Leu His Gln Val Val Gly Gln Leu Arg
305                 310                 315                 320
Glu Tyr Trp Asn Thr Thr Ile Ile Phe Lys Asn Ser Ser Gly Gly Asp
                 325                 330                 335
Leu Glu Ile Thr Thr His Ser Phe Asn Cys Gly Gly Glu Phe Phe Tyr
             340                 345                 350
```

```
Cys Asn Thr Ser Gly Leu Phe Asn Ser Asn Trp Thr His Asn Asp Thr
        355                 360                 365
Ala Ser Met Lys Pro Asn Asp Thr Ile Thr Leu Pro Cys Arg Ile Lys
        370                 375                 380
Gln Ile Ile Asn Met Trp Gln Arg Val Gly Gln Ala Ile Tyr Ala Pro
385                 390                 395                 400
Pro Ile Gln Gly Val Ile Arg Cys Glu Ser Asn Ile Thr Gly Leu Ile
                405                 410                 415
Leu Thr Arg Asp Gly Gly Gly Asn Ile Asn Glu Ser Gln Ile Phe Arg
                420                 425                 430
Pro Gly Gly Gly Asp Met Arg Asp Asn Trp Arg Ser Glu Leu Tyr Lys
                435                 440                 445
Tyr Lys Val Val Arg Ile Glu Pro Leu Gly Val Ala Pro Thr Lys Ala
        450                 455                 460
Lys Arg Arg Val Val Gln
465                 470
```

<210> 18
<211> 474
<212> PRT
<213> Human immunodeficiency virus

<400> 18
```
Ser Leu Trp Val Thr Val Tyr Tyr Gly Val Pro Val Trp Lys Glu Ala
  1               5                  10                  15
Thr Thr Thr Leu Phe Cys Ala Ser Asp Arg Lys Ala Tyr Asp Thr Glu
        20                  25                  30
Val His Asn Val Trp Ala Thr His Ala Cys Val Pro Thr Asp Pro Asn
        35                  40                  45
Pro Gln Glu Val Glu Leu Lys Asn Val Thr Glu Asn Phe Asn Met Trp
    50                  55                  60
Lys Asn Asn Met Val Glu Gln Met His Glu Asp Ile Ile Ser Leu Trp
65                  70                  75                  80
Asp Gln Ser Leu Lys Pro Cys Val Lys Leu Thr Pro Leu Cys Val Thr
                85                  90                  95
Leu Asn Cys Thr Asp Leu Arg Asn Ala Thr Asn Gly Asn Asp Thr Asn
            100                 105                 110
Thr Thr Ser Ser Ser Arg Gly Met Val Gly Gly Gly Glu Met Lys Asn
            115                 120                 125
Cys Ser Phe Asn Ile Thr Thr Asn Ile Arg Gly Lys Val Gln Lys Glu
    130                 135                 140
Tyr Ala Leu Phe Tyr Lys Leu Asp Ile Ala Pro Ile Asp Asn Asn Ser
145                 150                 155                 160
Asn Asn Arg Tyr Arg Leu Ile Ser Cys Asn Thr Ser Val Ile Thr Gln
                165                 170                 175
Ala Cys Pro Lys Val Ser Phe Glu Pro Ile Pro Ile His Tyr Cys Ala
            180                 185                 190
Pro Ala Gly Phe Ala Ile Leu Lys Cys Lys Asp Lys Lys Phe Asn Gly
        195                 200                 205
Lys Gly Pro Cys Thr Asn Val Ser Thr Val Gln Cys Thr His Gly Ile
        210                 215                 220
Arg Pro Val Val Ser Thr Gln Leu Leu Leu Asn Gly Ser Leu Ala Glu
225                 230                 235                 240
Glu Glu Val Val Ile Arg Ser Ala Asn Phe Ala Asp Asn Ala Lys Val
                245                 250                 255
Ile Ile Val Gln Leu Asn Glu Ser Val Glu Ile Asn Cys Thr Arg Pro
            260                 265                 270
```

```
Asn Asn Asn Thr Arg Lys Ser Ile His Ile Gly Pro Gly Arg Ala Phe
    275                 280                 285
Tyr Thr Thr Gly Glu Ile Ile Gly Asp Ile Arg Gln Ala His Cys Asn
    290                 295                 300
Leu Ser Arg Ala Lys Trp Asn Asp Thr Leu Asn Lys Ile Val Ile Lys
305                 310                 315                 320
Leu Arg Glu Gln Phe Gly Asn Lys Thr Ile Val Phe Lys His Ser Ser
                325                 330                 335
Gly Gly Asp Pro Glu Ile Val Thr His Ser Phe Asn Cys Gly Gly Glu
                340                 345                 350
Phe Phe Tyr Cys Asn Ser Thr Gln Leu Phe Asn Ser Thr Trp Asn Val
                355                 360                 365
Thr Glu Glu Ser Asn Asn Thr Val Glu Asn Asn Thr Ile Thr Leu Pro
    370                 375                 380
Cys Arg Ile Lys Gln Ile Ile Asn Met Trp Gln Glu Val Gly Arg Ala
385                 390                 395                 400
Met Tyr Ala Pro Pro Ile Arg Gly Gln Ile Arg Cys Ser Ser Asn Ile
                405                 410                 415
Thr Gly Leu Leu Leu Thr Arg Asp Gly Gly Pro Glu Asp Asn Lys Thr
                420                 425                 430
Glu Val Phe Arg Pro Gly Gly Gly Asp Met Arg Asp Asn Trp Arg Ser
                435                 440                 445
Glu Leu Tyr Lys Tyr Lys Val Val Lys Ile Glu Pro Leu Gly Val Ala
    450                 455                 460
Pro Thr Lys Ala Lys Arg Arg Val Val Gln
465                 470


<210> 19
<211> 474
<212> PRT
<213> Human immunodeficiency virus


<400> 19
Ser Leu Trp Val Thr Val Tyr Tyr Gly Val Pro Val Trp Lys Glu Ala
  1               5                  10                  15
Asn Thr Thr Leu Phe Cys Ala Ser Asp Ala Lys Ala Tyr Asp Thr Glu
                20                  25                  30
Val His Asn Val Trp Ala Thr His Ala Cys Val Pro Thr Asp Pro Asp
        35                  40                  45
Pro Gln Glu Val Glu Leu Glu Asn Val Thr Glu Asn Phe Asn Met Trp
    50                  55                  60
Lys Asn Asn Met Val Glu Gln Met His Glu Asp Ile Ile Ser Leu Trp
65                  70                  75                  80
Asp Gln Ser Leu Lys Pro Cys Val Lys Leu Thr Pro Leu Cys Val Thr
                85                  90                  95
Leu Asn Cys Thr Asn Leu Arg Asn Asp Thr Asn Thr Thr Arg Asn Ala
                100                 105                 110
Thr Asn Thr Thr Ser Ser Glu Thr Met Met Glu Glu Gly Glu Ile Lys
                115                 120                 125
Asn Cys Ser Phe Asn Ile Thr Thr Ser Ile Arg Asp Lys Val Gln Lys
    130                 135                 140
Glu Phe Ala Leu Phe Tyr Lys Leu Asp Val Val Pro Ile Glu Asn Asp
145                 150                 155                 160
Thr Thr Ser Tyr Arg Leu Ile Ser Cys Asn Thr Ser Val Leu Thr Gln
                165                 170                 175
Ala Cys Pro Lys Val Ser Phe Glu Pro Ile Pro Ile His Phe Cys Ala
                180                 185                 190
```

Pro Ala Gly Phe Ala Ile Leu Lys Cys Lys Asp Lys Lys Phe Asn Gly
    195   200   205
Thr Gly Pro Cys Thr Asn Val Ser Thr Val Gln Cys Thr His Gly Ile
    210   215   220
Lys Pro Val Val Ser Thr Gln Leu Leu Leu Asn Gly Ser Leu Ala Glu
225   230   235   240
Glu Glu Val Val Ile Arg Ser Ala Asn Leu Ser Asp Asn Ala Lys Thr
            245   250   255
Ile Ile Val Gln Leu Asn Glu Ser Val Gln Met Asn Cys Thr Arg Pro
            260   265   270
Asn Asn Asn Thr Arg Lys Ser Ile His Ile Gly Pro Gly Arg Ala Phe
        275   280   285
Tyr Thr Thr Gly Glu Ile Ile Gly Asp Ile Arg Gln Ala His Cys Asn
    290   295   300
Leu Ser Arg Thr Lys Trp Asn Glu Thr Leu Lys Arg Ile Val Ile Lys
305   310   315   320
Leu Arg Glu Gln Tyr Glu Asn Lys Thr Ile Val Phe Asn Gln Ser Ser
            325   330   335
Gly Gly Asp Pro Glu Ile Val Met Leu Ser Phe Asn Cys Gly Gly Glu
            340   345   350
Phe Phe Tyr Cys Asn Ser Thr Lys Leu Phe Asn Ser Thr Trp Asn Gly
            355   360   365
Thr Glu Ser Asn Asn Thr Gly Asp Asp Pro Ile Val Leu Pro Cys Arg
    370   375   380
Ile Lys Gln Val Ile Asn Met Trp Gln Glu Val Gly Lys Ala Met Tyr
385   390   395   400
Ala Pro Pro Ile Arg Gly Gln Ile Arg Cys Ser Ser Asn Ile Thr Gly
            405   410   415
Leu Leu Leu Thr Arg Asp Gly Gly Asn Ser Asn Glu Thr Asn Thr Thr
            420   425   430
Glu Ile Phe Arg Pro Gly Gly Gly Asn Met Lys Asp Asn Trp Arg Ser
    435   440   445
Glu Leu Tyr Lys Tyr Lys Val Val Arg Ile Glu Pro Leu Gly Ile Ala
    450   455   460
Pro Thr Arg Ala Lys Arg Arg Val Val Gln
465   470

<210> 20
<211> 488
<212> PRT
<213> Human immunodeficiency virus

<400> 20
Ser Trp Gly Asn Leu Trp Val Thr Val Tyr Tyr Gly Val Pro Val Trp
  1   5   10   15
Lys Glu Ala Lys Thr Thr Leu Phe Cys Ala Ser Asp Ala Lys Ser Tyr
            20   25   30
Glu Lys Glu Val His Asn Val Trp Ala Thr His Ala Cys Val Pro Thr
        35   40   45
Asp Pro Asn Pro Gln Glu Ile Val Leu Gly Asn Val Thr Glu Asn Phe
    50   55   60
Asn Met Trp Lys Asn Asp Met Val Asp Gln Met His Glu Asp Ile Ile
65   70   75   80
Ser Leu Trp Asp Gln Ser Leu Lys Pro Cys Val Lys Leu Thr Pro Leu
                85   90   95
Cys Val Thr Leu Asn Cys Thr Glu Val Asn Val Thr Arg Asn Val Asn
            100   105   110

```
Asn Ser Val Val Asn Asn Thr Thr Asn Val Asn Asn Ser Met Asn Gly
        115                 120                 125
Asp Met Lys Asn Cys Ser Phe Asn Ile Thr Thr Glu Leu Lys Asp Lys
    130                 135                 140
Lys Lys Asn Val Tyr Ala Leu Phe Tyr Lys Leu Asp Ile Val Ser Leu
145                 150                 155                 160
Asn Glu Thr Asp Asp Ser Glu Thr Gly Asn Ser Ser Lys Tyr Tyr Arg
                165                 170                 175
Leu Ile Asn Cys Asn Thr Ser Ala Leu Thr Gln Ala Cys Pro Lys Val
                180                 185                 190
Ser Phe Asp Pro Ile Pro Ile His Tyr Cys Ala Pro Ala Gly Tyr Ala
                195                 200                 205
Ile Leu Lys Cys Asn Asn Lys Thr Phe Asn Gly Thr Gly Pro Cys His
    210                 215                 220
Asn Val Ser Thr Val Gln Cys Thr His Gly Ile Lys Pro Val Val Ser
225                 230                 235                 240
Thr Gln Leu Leu Leu Asn Gly Ser Leu Ala Glu Glu Gly Ile Ile Ile
                245                 250                 255
Arg Ser Glu Asn Leu Thr Asn Asn Val Lys Thr Ile Ile Val His Leu
                260                 265                 270
Asn Arg Ser Ile Glu Ile Val Cys Val Arg Pro Asn Asn Asn Thr Arg
                275                 280                 285
Gln Ser Ile Arg Ile Gly Pro Gly Gln Thr Phe Tyr Ala Thr Gly Asp
    290                 295                 300
Ile Ile Gly Asp Ile Arg Gln Ala His Cys Asn Ile Ser Arg Thr Asn
305                 310                 315                 320
Trp Thr Lys Thr Leu Arg Glu Val Arg Asn Lys Leu Arg Glu His Phe
                325                 330                 335
Pro Asn Lys Asn Ile Thr Phe Lys Pro Ser Ser Gly Gly Asp Leu Glu
                340                 345                 350
Ile Thr Thr His Ser Phe Asn Cys Arg Gly Glu Phe Phe Tyr Cys Asn
    355                 360                 365
Thr Ser Gly Leu Phe Ser Ile Asn Tyr Thr Glu Asn Asn Thr Asp Gly
    370                 375                 380
Thr Pro Ile Thr Leu Pro Cys Arg Ile Arg Gln Ile Ile Asn Met Trp
385                 390                 395                 400
Gln Glu Val Gly Arg Ala Met Tyr Ala Pro Pro Ile Glu Gly Asn Ile
                405                 410                 415
Ala Cys Lys Ser Asp Ile Thr Gly Leu Leu Leu Val Arg Asp Gly Gly
                420                 425                 430
Ser Thr Asn Asp Ser Thr Asn Asn Asn Thr Glu Ile Phe Arg Pro Ala
                435                 440                 445
Gly Gly Asp Met Arg Asp Asn Trp Arg Ser Glu Leu Tyr Lys Tyr Lys
    450                 455                 460
Val Val Glu Ile Lys Pro Leu Gly Ile Ala Pro Thr Glu Ala Lys Arg
465                 470                 475                 480
Arg Val Val Glu Arg Glu Lys Arg
                485
```

```
<210> 21
<211> 469
<212> PRT
<213> Human immunodeficiency virus

<400> 21
Ser Leu Trp Val Thr Val Tyr Tyr Gly Val Pro Val Trp Lys Asp Ala
 1               5                  10                  15
```

```
Asp Thr Thr Leu Phe Cys Ala Ser Asp Ala Lys Ala His Glu Thr Glu
        20                  25                  30
Val His Asn Val Trp Ala Thr His Ala Cys Val Pro Thr Asp Pro Asn
        35                  40                  45
Pro Gln Glu Ile His Leu Glu Asn Val Thr Glu Asn Phe Asn Met Trp
    50                  55                  60
Lys Asn Lys Met Val Glu Gln Met Gln Glu Asp Val Ile Ser Leu Trp
65                  70                  75                  80
Asp Gln Ser Leu Lys Pro Cys Val Lys Leu Thr Pro Leu Cys Val Thr
                85                  90                  95
Leu Thr Cys Thr Asn Ala Thr Leu Asn Cys Thr Asn Leu Thr Asn Gly
            100                 105                 110
Asn Lys Thr Thr Asn Val Ser Asn Ile Ile Gly Asn Leu Thr Asp Glu
        115                 120                 125
Val Arg Asn Cys Ser Phe His Met Thr Thr Glu Leu Arg Asp Lys Lys
    130                 135                 140
Gln Lys Val Tyr Ala Leu Phe Tyr Lys Leu Asp Ile Val Gln Ile Asn
145                 150                 155                 160
Ser Ser Glu Tyr Arg Leu Ile Asn Cys Asn Thr Ser Val Ile Lys Gln
                165                 170                 175
Ala Cys Pro Lys Ile Ser Phe Asp Pro Ile Pro Ile His Tyr Cys Thr
            180                 185                 190
Pro Ala Gly Tyr Ala Ile Leu Lys Cys Asn Asp Lys Asn Phe Asn Gly
        195                 200                 205
Thr Gly Pro Cys Lys Asn Val Ser Ser Val Gln Cys Thr His Gly Ile
    210                 215                 220
Lys Pro Val Val Ser Thr Gln Leu Leu Leu Asn Gly Ser Leu Ala Glu
225                 230                 235                 240
Glu Glu Ile Ile Ile Ser Ser Glu Asn Leu Thr Asn Asn Ala Lys Thr
                245                 250                 255
Ile Ile Val His Leu Asn Lys Ser Val Glu Ile Ser Cys Thr Arg Pro
            260                 265                 270
Ser Thr Asn Thr Arg Thr Ser Ile Arg Ile Gly Pro Gly Gln Val Phe
        275                 280                 285
Tyr Arg Thr Gly Asp Ile Thr Gly Asp Ile Arg Lys Ala Tyr Cys Glu
    290                 295                 300
Ile Asn Glu Thr Lys Trp Asn Glu Ala Leu Lys Gln Val Ala Gly Lys
305                 310                 315                 320
Leu Lys Glu His Phe Asn Lys Thr Ile Ile Phe Gln Pro Pro Ser Gly
                325                 330                 335
Gly Asp Leu Glu Ile Thr Met His His Phe Asn Cys Arg Gly Glu Phe
            340                 345                 350
Phe Tyr Cys Asp Thr Thr Gln Leu Phe Asn Arg Thr Trp Gly Glu Asn
        355                 360                 365
Glu Thr Arg Glu Gly Arg Asn Ile Thr Leu Pro Cys Lys Ile Lys Gln
    370                 375                 380
Ile Val Asn Met Trp Gln Gly Ala Gly Gln Ala Met Tyr Ala Pro Pro
385                 390                 395                 400
Ile Ser Gly Ile Ile Lys Cys Val Ser Asn Ile Thr Gly Ile Leu Leu
            405                 410                 415
Thr Arg Asp Gly Gly Ala Asn Asn Ser Ala Ser Glu Thr Phe Arg Pro
        420                 425                 430
Gly Gly Gly Asn Ile Lys Asp Asn Trp Arg Ser Glu Leu Tyr Lys Tyr
        435                 440                 445
Lys Val Val Gln Ile Glu Pro Leu Gly Ile Ala Pro Thr Arg Ala Lys
    450                 455                 460
Arg Arg Val Val Gln
```

465